

MID workshop: User research and new developments

EuXFEL/DESY user meeting satellite workshop
24 January 2022

Anders Madsen
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Date			
time	title	speaker	institution
9:15-9:30	Welcome	Anders Madsen	European XFEL
9:30-10:00	Overview of the MID instrument	Ulrike Boesenberg	European XFEL
10:00-10:30	Data at MID: corrections and analysis	Johannes Möller	European XFEL
Break			
10:45-11:15	Imaging via speckle correlations of X-ray fluorescence	Fabian Trost	CFEL
11:15-11:45	The Effects of High Intensity X-ray Laser Pulses In MHz-XPCS Measurements of Protein Solution Dynamics	Mario Reiser	Stockholm University
11:45-12:15	Microsecond dynamics in complex liquids with MHz XPCS	Francesco Dallari	DESY
Lunch break			
13:30-14:00	First pump-probe femtosecond X-ray diffraction experiments at MID	Roman Shayduk	European XFEL
14:00-14:30	Imaging and scattering of cavitation in water	Tim Salditt	Universität Göttingen
14:30-15:00	PULsed MAGnet field (PUMA) project	Karina Kazarian	European XFEL
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15:45-16:15	Update on the split-and-delay line at MID	Wei Lu	European XFEL
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16:30-17:00	Update on special machine modes: self-seeding, short pulses and harder X-rays at SASE-2	C. Lechner, W. Qin, Y. L. Chen/F. Brinker	European XFEL/ DESY
17:00-17:30	Discussion and close-out		

190 registered participants

News from instrument

News from users

Chairs: Jörg Hallmann (morning)

Alexey Zozulya (afternoon)

Talks 25+5 min (time for few questions)

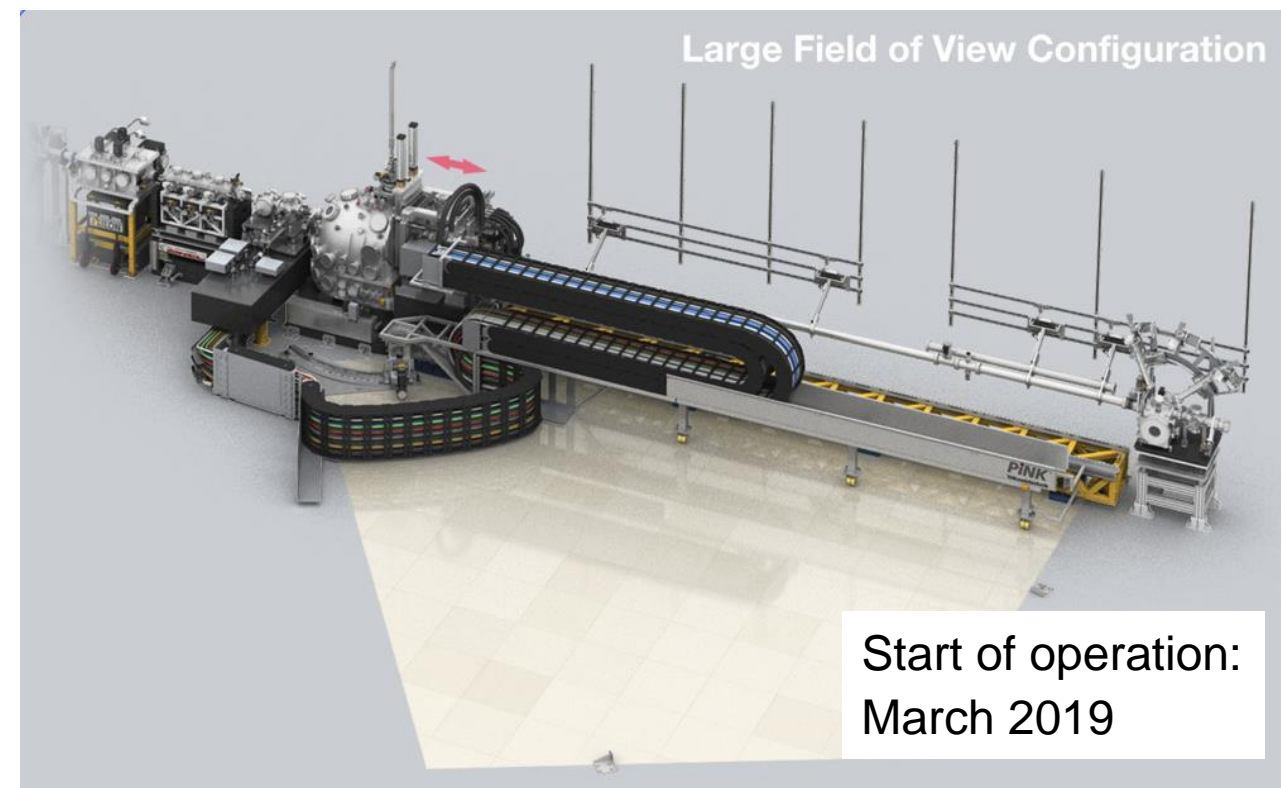
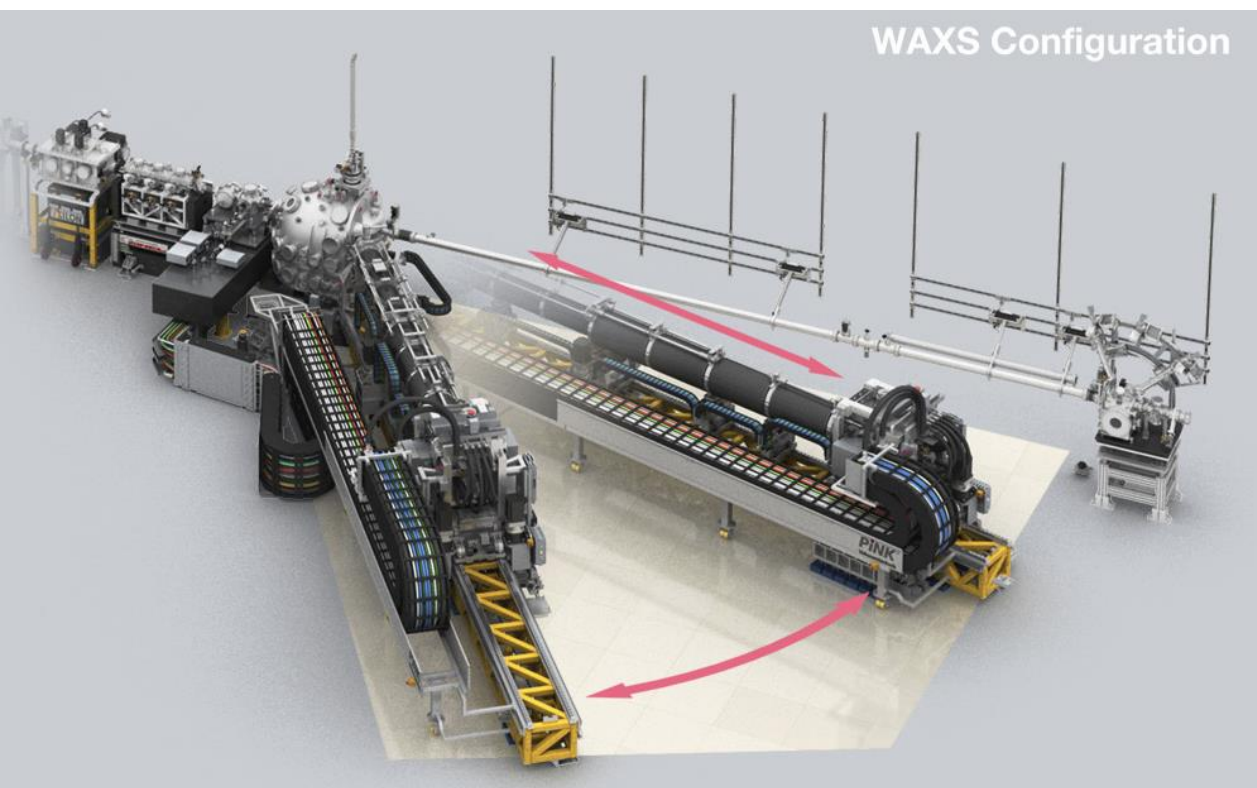
Discussion session at 17:00

Materials Imaging and Dynamics (MID) instrument at the European X-ray Free-Electron Laser Facility

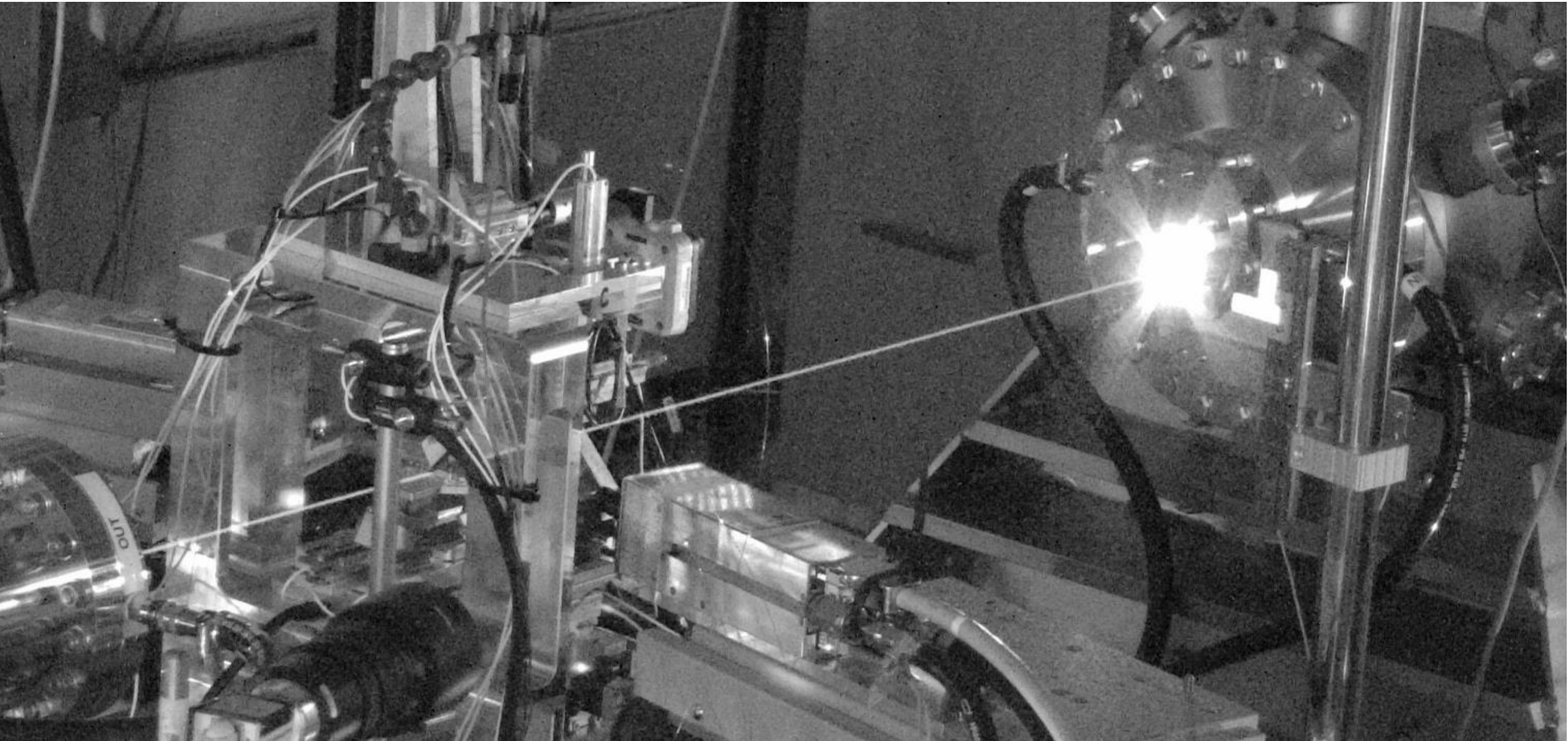


A. Madsen,* J. Hallmann, G. Ansaldi, T. Roth, W. Lu, C. Kim, U. Boesenberg,
A. Zozulya, J. Möller, R. Shayduk, M. Scholz, A. Bartmann, A. Schmidt, I. Lobato,
K. Sukharnikov, M. Reiser, K. Kazarian and I. Petrov

J Synchrotron Rad (2021) **28**, 637

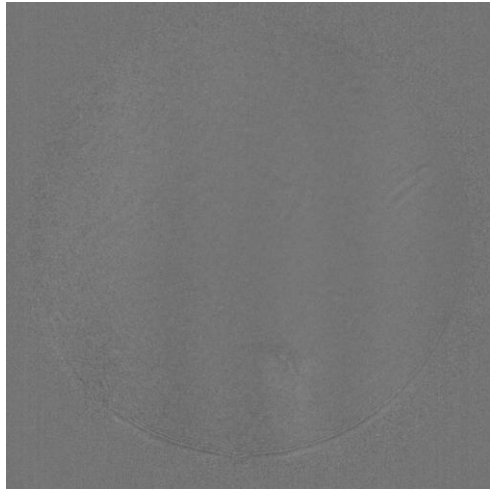


Materials Imaging and Dynamics (MID) instrument

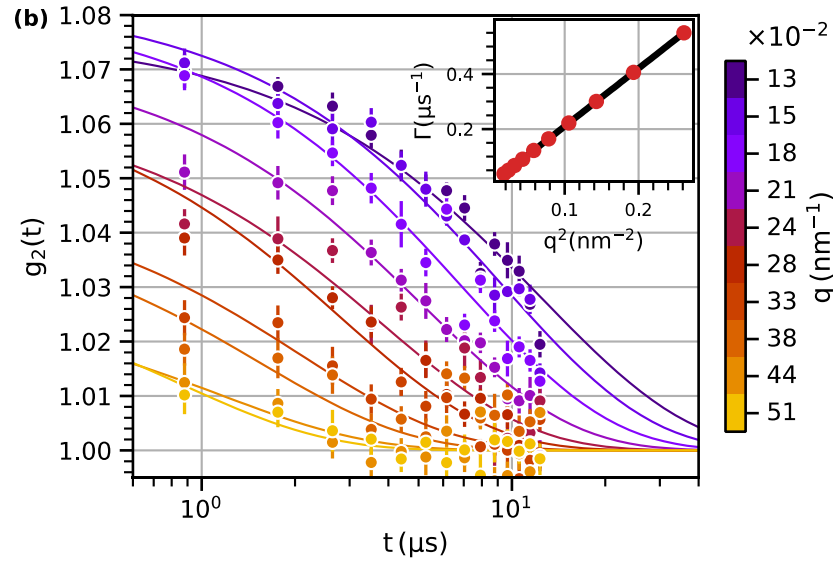


Broad range of science

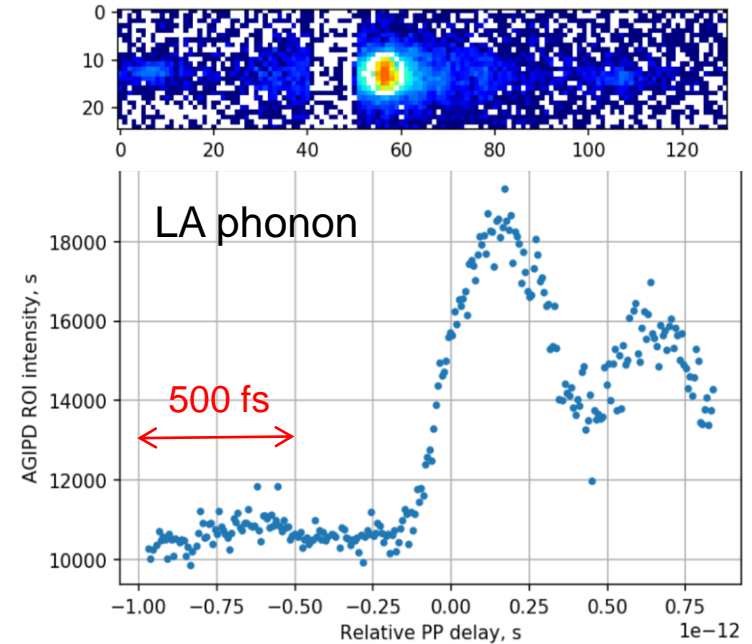
TR Imaging (holography)



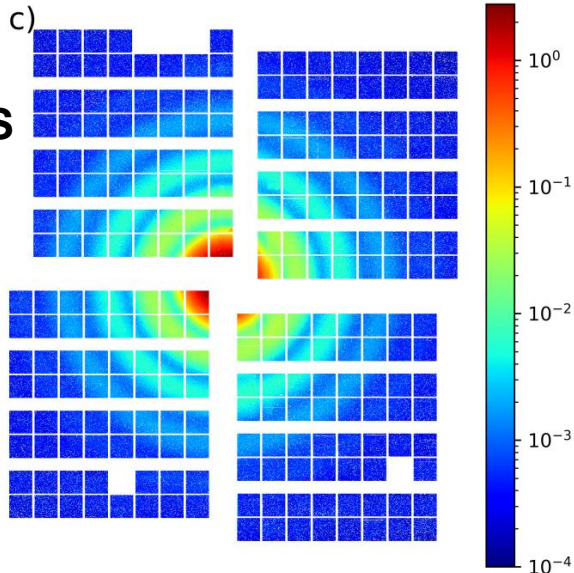
MHz XPCS



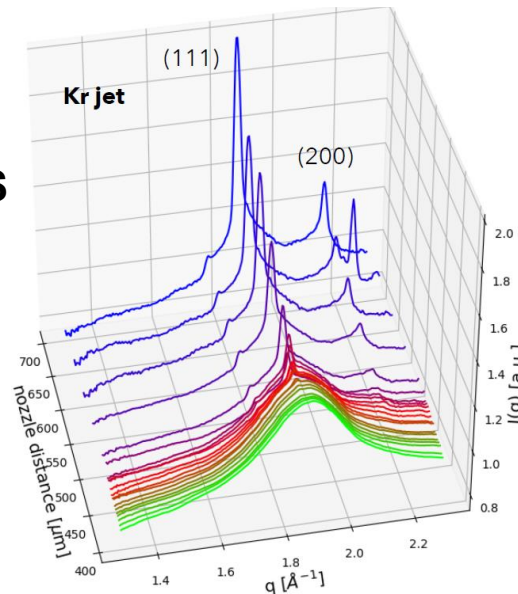
Laser pump – X-ray probe



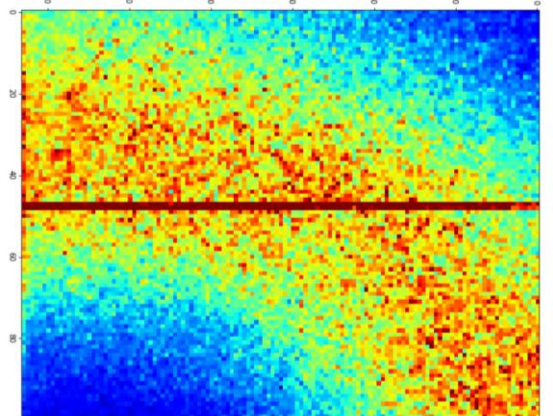
TR-SAXS



TR-WAXS



Coherent scattering and speckle



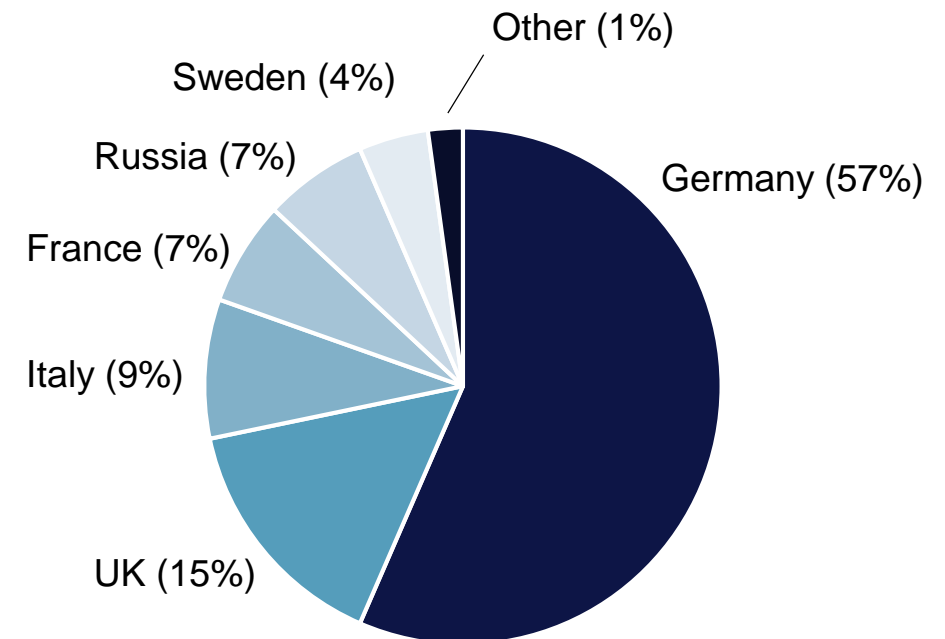
User statistics

- 2019-I 5 user experiments
- 2019-II 3 user experiments; 4 rescheduled exp
- 2020-I 0 user experiments + 1 rescheduled exp (Corona lockdown)
- 2020-II 1 user experiment + 1 rescheduled exp (remote)
- 2021-I 0 user experiments (7-11 mode, delayed restart of SASE-2)
- 2021-II 7 user experiments (7-11 mode, mostly remote)
- 2022-I 7 user experiments (7-11 mode, mostly remote)

23 unique user experiments

■ Science fields

48% XPCS; 22% imaging; 13% pump-probe;
9% various scattering; 8% other



User statistics (MP & PI per proposal)

Publications

All MID publications (users, staff) in online searchable database (articles, proceedings, book chapters,...)

<https://xfel.tind.io/>

First 6 user publication out in 2021 with data from experiments carried out in 2019 (3-4 more in pipeline)

Numerous technical, theoretical and IHR papers published and submitted

Articles (72)

Journal Article (2021)

Using low dose x-ray speckle visibility spectroscopy to study dynamics of soft matter samples

J. Möller, M. Reiser, J. Hallmann, U. Bösenberg, A. Zozulya, H. Rahmann, A.-L. Becker, F.

Westermeier, T. Zinn, M. Sprung, T. Narayanan, C. Gutt, A. Madsen

New J. Phys. **23** (9), 093041 (2021)

[doi:10.1088/1367-2630/ac2594](https://doi.org/10.1088/1367-2630/ac2594)

Journal Article (2021)

Analysis Strategies for MHz XPCS at the European XFEL

F. Dallari, M. Reiser, I. Lokteva, A. Jain, J. Möller, M. Scholz, A. Madsen, G. Grübel, F. Perakis, F.

Lehmkuhler

Appl. Sci. **11** (17), 8037 (2021)

[doi:10.3390/app11178037](https://doi.org/10.3390/app11178037)

Journal Article (2021)

Microsecond hydrodynamic interactions in dense colloidal dispersions probed at the European XFEL

F. Dallari, A. Jain, M. Sikorski, J. Möller, R. Bean, U. Bösenberg, L. Frenzel, C. Goy, J. Hallmann, Y.

Kim, I. Lokteva, V. Markmann, G. Mills, A. Rodriguez Fernandez, W. Roseker, M. Scholz, R. Shayduk,

P. Vagovic, M. Walther, F. Westermeier, A. Madsen, A. Mancuso, G. Grübel, F. Lehmkuhler

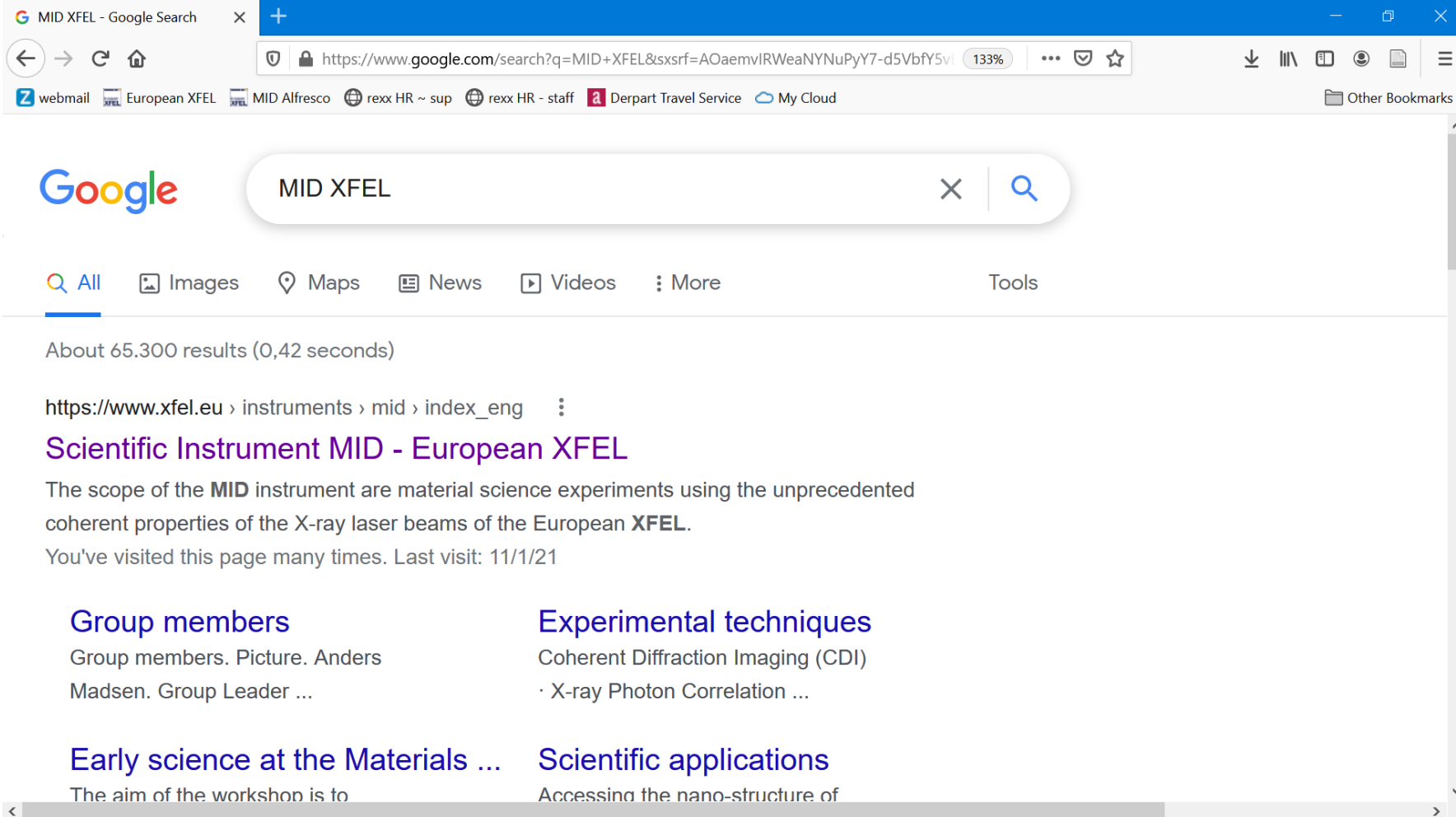
IUCrJ **8** (5), 775–783 (2021)

[doi:10.1107/S2052252521006333](https://doi.org/10.1107/S2052252521006333)

Journal Article (2021)

Resolution of a bent-crystal spectrometer for X-ray free-electron laser pulses: diamond versus silicon

Need more information?



The screenshot shows a Google search for "MID XFEL". The search results page displays the following information:

- Search results: About 65.300 results (0,42 seconds)
- URL: https://www.xfel.eu/instruments/mid/index_eng
- Title: **Scientific Instrument MID - European XFEL**
- Description: The scope of the **MID** instrument are material science experiments using the unprecedented coherent properties of the X-ray laser beams of the European **XFEL**.
- Last visit: 11/1/21
- Group members: Anders Madsen, Group Leader ...
- Experimental techniques: Coherent Diffraction Imaging (CDI), X-ray Photon Correlation ...
- Early science at the Materials ...
- Scientific applications: Accessing the nano-structure of ...

mid-info@xfel.eu

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Those were the days...

Discussion

Some common themes from talks and discussions

Experimental challenges

- XFEL beam often an invasive probe, can be dealt with in many cases (hardware, data analysis) but maybe not always
- From bug to feature, correlation before aggregation, everything is X pump - X probe, doesn't facilitate interpretation....
- Huge data amounts: MHz → PB

MID setup

- AGIPD detector is fundamental for MHz operation but tricky
- Large pixel size → small speckle contrast (SNR challenge)
- NAFO has limited intensity throughput (Be damage limit, limited aperture)
- Diagnostics essential for data analysis
- "Open port" feature used in several experiments

New developments for new experiments

- Self-seeding, harder X-rays, shorter pulses
- X-ray Split-Delay Line, PUMA + cryostat
- Optical laser operation for fs diffraction experiments

Remote operation experience

- Should we change the way we do experiments post-corona?

Other?

Slides will be made available
via link (wait for email)